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UNH Scientists Helping NOAA Probe Winter Air Chemistry Mystery

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Media Relations

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DURHAM, N.H. – Researchers from the University of New Hampshire have joined National Oceanic and Atmospheric Administration (NOAA) scientists and other colleagues from around the nation in Erie, Colo., to take part in a month-long air chemistry study with implications on both climate and air quality.

The Nitrogen, Aerosol Composition, and Halogens on a Tall Tower (NACHTT) study is an effort to decipher why and how the compound nitryl chloride, which is usually associated with the atmosphere near oceans, also forms during the winter nighttime in land-locked regions like the foothills of the Rocky Mountains. Some likely suspects include wood burning, pollution from power plants, and road de-icing chemicals.

As the Sun rises, nitryl chloride breaks apart quickly and releases chlorine atoms. Chlorine atoms can react with many other compounds, contributing to smog formation, and can also influence chemical cycles that destroy or produce various greenhouse gases, including ozone and methane.

Says participating scientist Alex Pszenny of the UNH Institute for the Study of Earth, Oceans, and Space, "The chlorine essentially acts as an accelerant for the photochemistry that leads to ozone production, and for the oxidation processes that consume methane. Both ozone and methane are important climate-forcing gases."

Pszenny and UNH chemistry graduate student Andrew Young are collaborating with William Keene of the University of Virginia to study the role that soluble gases and aerosol particle composition plays in the mysterious appearance of nitryl chloride. The National Science Foundation is funding their portion of the experiment.

"Nighttime formation of nitryl chloride is a gateway to forming more highly reactive chlorine atoms," says Steve Brown, the scientist at the NOAA Earth System Research Laboratory (ESRL) in Boulder, Colo., who is leading the study in Erie. "It changes the atmosphere's starting point for the next day."

The Erie Tower, formally known as NOAA's Boulder Atmospheric Observatory, gives the scientists a distinct advantage in looking at the wintertime atmosphere, which is made up of "layers" that don't mix well. As a consequence, what's in the air and its chemical interactions vary with height, and therefore can't be fully understood by making measurements at the ground level only. A new mobile "Tower Laboratory" platform built at NOAA can carry more than one ton of instrumentation up and down the 984-foot tower allowing characterization of the chemistry at different heights.

NACHTT researchers brought an arsenal of instruments, many of them custom built, to solve the mystery of nitryl chloride. Pszenny and Keene of UVA have combined instruments and sampling devices from both their laboratories to study soluble gases like hydrochloric acid and ammonia, and aerosol composition. Analysis of the data will allow them to estimate the acidity of the aerosol.

"And that's important because the chemical mechanisms as we now understand them require that the aerosol be acidic for generation of nitryl chloride and other compounds, which is at the heart of this nighttime chemistry we believe leads to impacts on air quality, ozone production, and methane oxidation," Pszenny says.

For more on the NACHTT experiment visit http://www.esrl.noaa.gov/csd/tropchem/2011NACHTT/

The University of New Hampshire, founded in 1866, is a world-class public research university with the feel of a New England liberal arts college. A land, sea, and space-grant university, UNH is the state's flagship

public institution, enrolling 12,200 undergraduate and 2,300 graduate students.

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